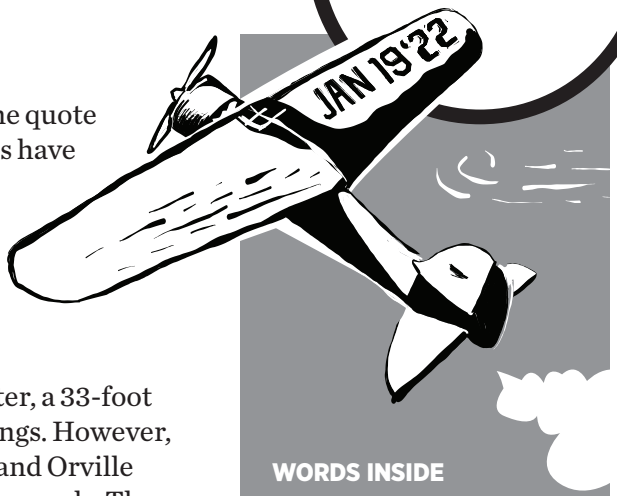
THE WARBLER

AN EDUCATIONAL WEEKLY

ISSUE 93

Dear Student, Artist, Thinker,



"The bird who dares to fall is the bird who learns to fly" is just one quote of many emulating the human fixation on birds. And while birds have many aspects that could be wasteful if transferred to humans, there is one trait that has been enviable for all time: the ability to fly. For as long as humans have known of the concept of **flight**, attempts have been made to understand the mysteries of flight. A model aircraft was discovered in the Saqqara burial grounds dating all the way back to 200 BCE. Even Leonardo da Vinci attempted to invent a 'flying machine' called an ornithopter, a 33-foot winged model that uses a pulley and pedal system to flap the wings. However, it was not until December 17, 1903, when two brothers, Wilbur and Orville Wright, were finally able to take to the sky — at least for twelve seconds. They conducted four test flights that day in Kitty Hawk with the last flight lasting 59 seconds and reaching 859 feet till crashing across the sand. While the original "Wright Flyer" was too smashed up to achieve flight again, the brothers had gained enough information from these tests to make more sustainable planes.

This led to the first commercial air travel with the St. Petersburg-Tampa Airboat Line flying across Tampa Bay on January 1, 1914. The Airboat Line safely transported 1,204 passengers across the bay before closing in March. Today, the FAA reports more than 45,000 flights and 2.9 million airline passengers take to the sky per day. And while those are only commercial purposes for places on Earth, as the article "SpaceX takes 4 passengers to orbit" states, many individuals are attempting to revolutionize spaceflight and make it accessible to more of the public through space tourism. While still not able to achieve flight quite as easily as a bird, these technological advancements have made it possible for humans to fly, even out of our own stratosphere. We hope you enjoy learning more about the history and current advancements of flight in this edition of *The Warbler*.

Julia and the APAEP team

"The moment you doubt whether you can fly, you cease forever to be able to do it."

J.M. BARRIE // **'PETER PAN'** // Scottish Novelist

WORDS INSIDE

FOUND INSIDE "ARTEMIS ..."

preliminary | an action or event preceding or done in preparation for something fuller or more important

jettison | throw or drop something from an aircraft or ship

depot | a place for the storage of large quantities of equipment, food, or some other commodity

FOUND INSIDE "SPACEX TAKES 4 PASSENGERS ..."

prosthesis | an artificial body part

charter | the reservation of an aircraft, boat, or bus for private use

centrifuge | a method of separating molecules having different densities by spinning them in solution around an axis

• • •

SCIENCE

Scientists Use Nuclear Reactor to Investigate Amelia Earhart's Mysterious Disappearance

BY TIBI PUIU | *ZME Science* | February 16, 2021

One of the bravest women of the 20th century, Amelia Earhart, vanished unexpectedly during her attempt to fly around the world. Now, scientists have turned to nuclear technology to analyze a piece of metal debris that some suspect was part of Earhart's wrecked plane. In doing so, they hope to piece together the final moments of the pioneering aviator's final living hours.

Earhart, March 1937, Oakland, California, before departing on her final round-the-world attempt prior to her disappearance.

Photo from Wikimedia Commons

A tragic end to a brave pioneer

Amelia Earhart was the first female pilot to fly across the Atlantic Ocean. In 1937, Earhart and her navigator, Fred Noonan, were flying their Lockheed Model 10-E Electra on an even more ambitious quest: flying around the world. On July 2, 1937, they were about six weeks and 20,000 miles into their journey when their plane suddenly crashed en route to Howland Island in the Pacific, which is halfway between Hawaii and Australia.

The Howland Island is a flat sliver of land about 2,000 meters (6,500 feet) long and 460 meters (1600 feet wide), so it must have been very difficult to distinguish from similar-looking clouds' shapes from Earhart's altitude. Of course, Earhart and Noonan were well aware of the challenges, which is why they had an elaborate plan that involved tracking their routes using celestial navigation and linking to a U.S. Coast Guard vessel stationed off Howland Island using radios.

But despite their well-thought-out contingency plans, the pair were simply flat out of luck. When they took off, witnesses reported that a radio antenna may have been damaged by the maneuver. On that morning, there were also extensive overcast conditions. Later investigations also showed that the fliers may have been using outdated, inaccurate maps.

On the morning of July 2, 1937, at 7:20 AM, Earhart reported her position to the crew at the Coast Guard vessel, placing her plane on a course at 32 kilometers (20 miles) southwest of the Nukumanu Islands.

Despite a huge search and rescue mission involving 66 aircraft and nine ships, the fate of the two flyers remains a mystery to this day. With the years, the mystery only intensified, amplified by countless conspiracy theories surrounding Earhart's last days.

While watching a National Geographic documentary on the disappearance of Earhart, Daniel Beck, a pilot who also manages the engineering program for the Penn State Radiation Science and Engineering Center (RSEC), home to the Breazeale Nuclear Reactor, was shocked by a particular scene discussing an aluminum panel believed to be part of the wrecked airplane. The documentary ended with the idea that, perhaps, sometime in the future, technology will advance to the point where scientists can elucidate more information from the panel.

The scientist got ahold of Richard "Ric" Gillespie, who leads The International Group for Historic Aircraft Recovery (TIGHAR) and was featured in the documentary and offered to analyze the metal part using neutron technology at his lab.

The metal panel had been recovered in storm debris on Nikumaroro, a Pacific island located about 480 kilometers (300 miles) away from Howland Island. Some have suggested before that Earhart's plane made an emergency landing on the reef surrounding the small, uninhabited island. A human skeleton was even found in 1940, and although the bones were lost, a 2018 study found that the historical records of the bones' measurements matched Earhart's closer than 99% of the general population.

Beck and colleagues placed the sample in front of the neutron beam, while a digital imaging plate was placed behind the sample. As the neutron beam passed through the sample and then through the imaging plate, an image was recorded and digitally scanned.

"It doesn't appear that this patch popped off on its own," Beck said. "If it was chopped with an axe, we should see peaks for iron or nickel left by the axe along that edge. Neutron activation analysis gives us that detail at a very fine resolution."

For now, the researchers plan on performing more examinations using more comprehensive experiments, including adjusting the irradiation time and power level of the reactor.

Even if they eventually don't find anything in connection to Earhart, this inquiry is still valuable. For one, it disqualifies the object so other people don't waste time in the future. Secondly, it sets a precedent that may spur more research with neutron radiography.

"It's possible we'll learn something that actually disqualifies this artifact from being part of Earhart's plane, but I prefer the knowing! It is so exciting to work with scientists who share our passion for getting to the truth, whatever it is," Gillespie said in a statement. ●

"I fly because it releases my mind from the tyranny of petty things."

ANTOINE DE SAINT-EXUPERY // French writer

Edited for space

TECHNOLOGY

Why a Mach 5 Passenger Plane is a Crazy Idea that Might Just Work

BY JACOPO PRISCO | *CNN* | October 16, 2021

Almost two decades since Concorde retired, interest around supersonic travel has been picking up pace, and several super-fast planes are under development. Airlines seem interested: United has already committed itself to offering supersonic routes as early as 2029.

But what about hypersonic travel, which happens at speeds of Mach 5 — five times the speed of sound — and above? That would get an aircraft from New York to London in just 90 minutes, compared to about three hours for Concorde, and between six to seven hours for a regular passenger jet.

Hermeus, an Atlanta-based startup whose goal is to develop hypersonic aircraft, believes so. It's already testing a new type of engine it says will eventually be capable of reaching Mach 5 (over 3,000 mph). The engine is designed for a small, unmanned hypersonic aircraft Hermeus is currently creating for the US Air Force, but scaled to a bigger size, it will be able to power a passenger plane.

That passenger plane is a long way away — Hermeus hopes to get it in the air for the first test flight before the decade is out, in 2029 — but because its technology has to be built almost entirely from the ground up, the company is already planning it out.

To understand how daring the idea of a Mach 5 passenger plane is, it's useful to look at flight speed records.

The fastest any aircraft with an engine has ever flown is Mach 9.6 (about 6,800 mph), a record set in 2004 by the NASA X-43A — an unmanned aircraft measuring about 12 feet in length.

Because that flight only lasted a few seconds, the record for the longest sustained flight above Mach 5 belongs to the Boeing X-51, another unmanned experimental aircraft, which in 2013 flew for over three minutes at Mach 5.1 (about 3,400 mph). Both aircraft had to be launched from altitude by a B-52 bomber, and then brought up to speed by a rocket, highlighting the intricacies of these type of high-speed flights.

For aircraft with humans on board, the current absolute speed record is Mach 6.7 (4,520 mph), set in 1967 by the X-15. It was basically a rocket with a seat, designed to achieve the record, and also had to be launched from altitude by a B-52.

For an air-breathing aircraft — that is, powered by jet engines rather than a rocket — capable of taking off and landing by itself, the speed record is "just" Mach 3.3 (about 2,200 mph), set by the SR-71 Blackbird, a military spy plane, in 1976.

The top speed of Concorde, one of only two supersonic passenger planes to have flown commercially, was Mach 2.04 (1,350 mph).

The proposed Hermeus passenger aircraft, therefore, would beat the current record for the fastest air-breathing plane by a large margin, and by flying for an extended time at Mach 5, it would outclass an achievement currently in the realm of unmanned experimental vehicles (of course, other aircraft might beat these records in the future before Hermeus does).

Hermeus is an American startup building a hypersonic passenger plane that could travel from NYC to London in just 90 minutes (artist's impression).

IMAGE BY Hermeus

It's unsurprising, then, that the initial focus of the company is on the engine. Tests started in February 2020 for a new type of engine design, based on an existing model used in fighter aircraft and manufactured by General Electric.

It will be a hybrid of two traditional technologies: a turbojet, which is similar to what airliners use, and a ramjet, a type of engine that only works at supersonic speeds and above. Initially, the engine will power Quarterhorse, the sleek hypersonic drone that Hermeus is developing through a $60 million partnership with the US Air Force.

Interestingly, when designing a jet engine to go faster, parts are removed rather than added. In a turbojet, the air enters from the front and is first compressed (to increase its energy potential) by rotating blades, then mixed with fuel and ignited. The resulting hot gas is blasted out through the back of the engine, pushing the plane forward.

Hermeus will use its hybrid engine in turbojet mode when taking off and landing, as well as at subsonic speeds. Then, the engine will gradually reconfigure itself into a ramjet mode as it reaches Mach 3 and until Mach 5.

"The turbojet portion and the ramjet portion by themselves are mature technologies that we've been using for 50 years. The trick is to put them together, so we designed our own architecture around an off-the-shelf turbojet engine and then built out from there," says Piplica. ●

Edited for space and clarity

MATHEMATICS

Sudoku

#185 PUZZLE NO. 266989

3			8					
2		5	4					
		1		2	9		5	
		6				2	4	
		2			6			5
1					4		9	
						1	7	3
6	4		1					
5							8	

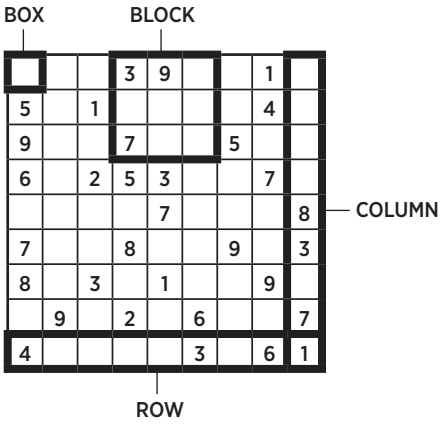
#186 PUZZLE NO. 9767748

	7		2	1				
1	5		6	8				
								7
	4			7			2	9
6		8		2	4			
								5
	8	2		9			1	
4								8
		1	3					

©Sudoku.cool

SUDOKU HOW-TO GUIDE

1. Each block, row, and column must contain the numbers 1–9.
2. Sudoku is a game of logic and reasoning, so you should not need to guess.
3. Don't repeat numbers within each block, row, or column.
4. Use the process of elimination to figure out the correct placement of numbers in each box.
5. The answers appear on the last page of this newsletter.



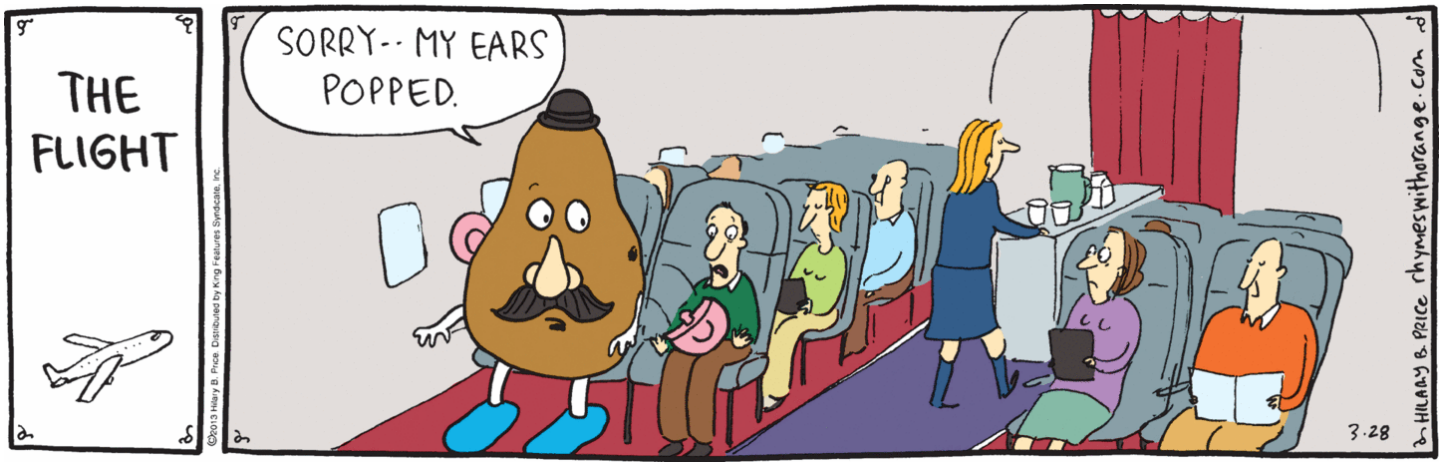
What the example will look like solved

2	4	8	3	9	5	7	1	6
5	7	1	6	2	8	3	4	9
9	3	6	7	4	1	5	8	2
6	8	2	5	3	9	1	7	4
3	5	9	1	7	4	6	2	8
7	1	4	8	6	2	9	5	3
8	6	3	4	1	7	2	9	5
1	9	5	2	8	6	4	3	7
4	2	7	9	5	3	8	6	1

"Both optimists and pessimists contribute to our society. The optimist invents the airplane and the pessimist the parachute."

GIL STERN // Irish playwright

Icons from the Noun Project



Idiom

"Fly by the seat of your pants"

Meaning Going along with things; making decisions as you go. Not planning ahead.

Origin This term comes from aviation. When people first began flying aircraft, they did not have the same advanced navigation tools and abilities to communicate with people on the ground. Therefore, people were flying by the seat of their pants or flying without the ability to communicate or fully plan things out.

In a description of Douglas Corrigan's flight from the USA to Ireland in 1938, the phrase was first used in The Edwardsville Intelligencer:

"Douglas Corrigan was described as an aviator 'who flies by the seat of his pants' today by a mechanic who helped him rejuvenate the plane which airport men have now nicknamed the 'Spirit of $69.90.' The old flying expression of 'flies by the seat of his trousers' was explained by Larry Conner, means going aloft without instruments, radio or other such luxuries."

Source: https://writingexplained.org/idiom-dictionary/fly-by-the-seat-of-your-pants

DID YOU KNOW?

Plane pilots and co-pilots are often required to **eat different meals** in case one is tainted.

Flight crew employees only get paid when they're **in the air**.

Crews **dim lights** for takeoff and landing so that their eyes can adjust to the dark in the case of an emergency.

Airplane toilets use a **vacuum** system to flush the contents of the bowl down into a tank in the tail of the plane.

At takeoff and landing, planes travel between **150 and 200 miles per hour**.

Source: thrillist.com

AT ANY GIVEN TIME, THERE ARE **9,700 PLANES** IN THE SKY.

THE AIR INSIDE OF AN AIRPLANE IS AS DRY AS THE **SAHARA DESERT** AT ABOUT 20% HUMIDITY.

"The desire to fly is an idea handed down to us by our ancestors who, in their grueling travels across trackless lands in prehistoric times, looked enviously on the birds soaring freely through space, at full speed, above all obstacles, on the infinite highway of the air."

WILBUR WRIGHT // American aviation pioneer

ART + CULTURE

High Flight

BY JOHN GILLESPIE MAGEE (1922-1941)

Oh! I have slipped the surly bonds of earth
And danced the skies on laughter-silvered wings;
Sunward I've climbed, and joined the tumbling mirth
Of sun-split clouds — and done a hundred things
You have not dreamed of — wheeled and soared and swung
High in the sunlit silence. Hov'ring there,
I've chased the shouting wind along, and flung
My eager craft through footless halls of air.

Up, up the long, delirious, burning blue
I've topped the wind-swept heights with easy grace
Where never lark, or even eagle flew —
And, while with silent lifting mind I've trod
The high untrespassed sanctity of space,
Put out my hand and touched the face of God.

John Gillespie Magee born in Shanghai, China, of missionary parents-an American father and an English mother, and spoke Chinese before English. He was educated at Rugby school in England and at Avon Old Farms School in Connecticut. He won a Scholarship to Yale, but instead joined the Royal Canadian Air Force in late 1940, trained in Canada, and was sent to Britain. He flew in a Spitfire squadron and was killed on a routine training mission on December 11, 1941.

WRITING PROMPT

As Wilbur and Orville Wright, the inventors of the first airplane, imagined building an airplane, they studied the flight of birds. They studied the ways birds' wings worked to determine what made them so efficient for flying, and they discovered that birds could fly because of the ability to twist and rotate their wings. This process of studying objects and taking close observation for inspiration of work is also a great tactic for creative writing. This week, closely observe an object or being of your choosing and use this study as inspiration for a poem, short story, or creative non-fiction essay.

Word Search

O	V	B	O	R	L	D	C	D	C	L	R	G	L
P	P	R	P	U	H	S	B	A	O	F	A	T	E
W	L	E	D	E	L	R	A	S	S	R	U	G	V
R	R	A	L	L	T	T	E	G	O	W	U	O	A
C	E	T	L	O	P	R	R	E	R	A	G	V	E
L	A	H	R	A	V	S	F	E	R	A	O	L	A
B	A	L	P	L	S	E	I	D	T	U	S	A	I
O	V	V	L	O	R	P	S	H	H	I	E	S	A
D	S	E	L	C	P	S	E	F	R	E	D	I	E
L	L	C	L	A	R	U	P	R	O	U	S	O	E
A	L	P	H	R	P	O	I	P	O	O	R	E	R
F	I	T	G	T	R	E	W	L	F	E	E	D	O
R	R	F	H	F	S	D	C	D	A	R	L	R	I
I	R	S	A	E	T	O	F	L	I	F	E	O	P

LIFE
LOVE
HAPPIER
GUARD
LOSS
FATE
POOR
BREATH
CLOUDS
CROWD

EXPLORATION

Artemis, NASA's Moon Landing Program

THE PLANETARY SOCIETY | November 21, 2021

What is the Artemis program? Humans have not left Earth orbit since Apollo 17 returned from the Moon in 1972. NASA has been trying to change that since 2004, when then-president George W. Bush announced the Vision for Space Exploration, an initiative to send humans back to the Moon and eventually to land on Mars. Since then, NASA's deep space efforts have had a number of names: Constellation (2004-2010, targeted lunar surface and Mars), Journey to Mars (2015-2018, targeted cislunar space, asteroid and Mars), and Moon to Mars (2018 to present, targeting lunar surface and Mars).

Through its current Artemis program, NASA envisions sending astronauts to the lunar south pole by 2024 and eventually establishing a permanent presence on the Moon. The program is a result of the Trump administration's Space Policy Directive 1 and a March 26, 2019 speech by Vice President Mike Pence directing NASA to reach the Moon by 2024, 4 years earlier than its previous goal.

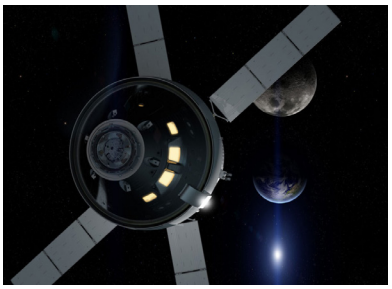
Artemis is designed to land humans on the Moon quickly, by 2024, and focus on Mars as a long-term human spaceflight goal after that. The preliminary short-term plan involves using both commercial rockets and NASA's Space Launch System, the Orion crew capsule, and a lunar landing system. A small space station in lunar orbit called the Gateway would serve future surface missions.

The Planetary Society's principles for human spaceflight lay out how we evaluate, support, and critique proposed plans for human spaceflight.

What is the Space Launch System? The Space Launch System, or SLS, is a massive rocket based on Space Shuttle-derived technology. It is essentially a larger version of the Shuttle stack that trades out the winged orbiter for either cargo or the Orion crew capsule on top. The vehicle's core stage is a stretched Shuttle external fuel tank powered by 4 Space Shuttle (RS-25) main engines. (During the Shuttle program these engines were refurbished and reused; for SLS they will be ditched in the ocean.) Assisting the core stage during the initial phase of flight is a pair of 5-segment Space Shuttle solid rocket boosters.

Orion

Orion is a crew vehicle capable of supporting up to 4 astronauts on deep-space journeys, similar in concept but having a larger interior than the gumdrop-shaped Apollo capsules. Unlike capsules designed solely for transportation to low-Earth orbit, Orion's heat shield can withstand the high-velocity reentry necessary when returning from deep space. The Orion spacecraft consists of three major components: a pressurized crew capsule, a service module, and a launch abort tower, which is nominally jettisoned during ascent.



Orion beyond the Moon.

Image from NASA

Lunar Gateway

The Lunar Gateway is a small space station in lunar orbit that would function as a fuel and supply depot, a science outpost, and a waypoint for missions to and from the lunar surface. The Gateway is currently not required to be operational for the initial 2024 Moon landing. NASA is asking commercial companies to provide Gateway cargo transportation services, similar to the way it does for the International Space Station.

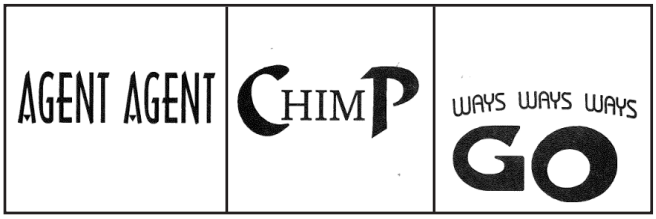
Capstone

NASA will send a small spacecraft called CAPSTONE (Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment) to the same lunar orbit Gateway will occupy. The microwave oven-sized CubeSat will test out a number of key technologies critical for Artemis, including spacecraft-to-spacecraft communication using the Lunar Reconnaissance Orbiter.

Lunar Landers

NASA is asking commercial companies to build lunar lander systems that would eventually dock with the Gateway. A visiting Orion crew would board the lander, take it to the surface, and return in either an ascent module or the entire vehicle. Early landers would only be capable of short surface stays, while future vehicles would be able to house crews through the lunar night. ●

WORD PLAY A Rebus puzzle is a picture representation of a common word or phrase. How the letters/images appear within each box will give you clues to the answer! For example, if you saw the letters "LOOK ULEAP," you could guess that the phrase is "Look before you leap." *Answers are on the last page!*



SPACE

SpaceX Takes 4 Passengers to Orbit — a Glimpse at Private Spaceflight's Future

The Inspiration4 crew will spend three days circling the planet on a mission that aims to raise $200 million for St. Jude Children's Research Hospital.

BY NADIA DRAKE | *National Geographic* | September 15, 2021

Just after 8 p.m. Eastern time, a SpaceX Crew Dragon capsule rocketed into orbit from NASA's Kennedy Space Center carrying humankind's first entirely private crewed mission into orbit.

None of the Inspiration4 mission's quartet of crew members is a professional astronaut. None have any previous spaceflight experience. Three of the passengers only learned they'd be visiting space earlier this year, when surprising announcements transformed their lives into a mélange of training and media spotlights.

Now the Inspiration4 crew is orbiting the planet, where they will enjoy three days of weightlessness, do a little science while they're at it, and help raise $200 million for Memphis-based St. Jude Children's Research Hospital. The crew is riding aboard a Dragon capsule named *Resilience*, and the flight will be entirely automated, allowing passengers with minimal flight experience to climb aboard and enjoy the ride.

Resilience previously ferried four NASA astronauts to the International Space Station, but this time, instead of docking with the station, the spacecraft will fly to an altitude of roughly 360 miles—some 80 miles higher than the ISS at its highest point. The crew will gaze at Earth through a custom glass dome that SpaceX recently installed in place of the spacecraft's docking port. And later this week, if all goes well, *Resilience* will splash down off the Florida coast.

The flight marks the first time since 2009 — when space shuttle *Atlantis* delivered astronauts to the Hubble Space Telescope for the final repair mission — that a crewed orbital flight hasn't visited a space station.

"This is fascinating because it is a commercial mission on a commercial vehicle. It's not going to a destination, none of the participants are government astronauts, nor have they been government astronauts," says industry analyst Carissa Christensen, founder of BryceTech. "It really is a new phenomenon."

The Inspiration4 mission commander is billionaire Jared Isaacman, who chartered the SpaceX vehicle for an undisclosed amount. Joining him are St. Jude physician assistant and childhood cancer survivor Hayley Arceneaux, the first person with a prosthesis to fly in space; Air Force veteran Chris Sembroski, whose seat was chosen by lottery; and internet contest winner Sian Proctor, a geoscientist who was nearly a member of NASA's 2009 astronaut class.

The Inspiration4 crew, from left to right, Hayley Arceneaux, Chris Sembroski, Jared Isaacman, and Sian Proctor, during a zero-gravity training flight.

Photograph by John Kraus, Inspiration4

"It's putting a lot of this into the hands of the billionaires and millionaires of the world, who can afford either to fly on these flights, or to give seats away on flights that they've chartered," says space historian Matt Shindell of Smithsonian's National Air and Space Museum. "I think the real test is going to be what happens next."

A new kind of ticket to space

Mission commander Isaacman, a 38-year-old who's keen on adventure, made his fortune from Shift4 Payments, a payment processing company he founded in 2005 that now handles more than $200 billion in retail sales annually. He is also an accomplished pilot and the co-founder of Draken International — which trains military pilots and operates the world's largest private fleet of fighter jets.

In October, Isaacman chartered the four-person SpaceX flight to orbit, telling *Axios* only that it cost less than $200 million. He then announced that the mission would double as a fundraising campaign for St. Jude, and that he wouldn't be flying with his friends or family. The other three seats would be filled somewhat haphazardly.

Naming the three open spots Hope, Generosity, and Prosperity, Isaacman appointed himself to the Leadership chair and assumed the title of mission commander.

In January, St. Jude staff selected Arceneaux, a former patient turned employee, for the Hope seat. When she was 10, Arceneaux was diagnosed with bone cancer and had surgery to replace her left knee and insert a titanium rod into her damaged thighbone. She's now the mission's medical officer.

"You wanna fly, you got to give up the ... [stuff] that weighs you down."

TONI MORRISON // American novelist

Sembroski, a data engineer who works for Lockheed Martin, will fill the Generosity seat — a prize awarded essentially randomly. After seeing a Super Bowl ad for the mission, Sembroski donated money to St. Jude, which entered him in a raffle. He didn't win the lottery, but his friend did — and that friend gave Sembroski the ticket.

Proctor won the last seat, Prosperity, after entering a competition that required her to open a Shift4 Shop and make a short video (the more viral the better) describing why she wanted to go to space and what she would bring to the mission.

As this crew demonstrates, the idea of an "astronaut" is quickly changing, says science historian Jordan Bimm of the University of Chicago. Historically, space agencies recruited military pilots for the job, later adding scientists and other specialists to successive sets of new recruits. Now the wealthy elite can buy their own rides into space and distribute tickets however they see fit.

Prepping for flight

Normally, NASA's astronaut crews are also carefully assembled, with mission managers working to craft a cohesive team that has the highest chance of successfully completing the mission. Then those crews train together for years.

Inspiration4 has followed a different path, with less than a year between Isaacman's initial conversation with SpaceX, crew selection, and the mission launch. For about six months, the group trained rigorously, with exercises including a 30-hour flight simulation and enough practice with the automated Dragon to monitor the spacecraft's health and hopefully survive any mishaps. The crew members also completed centrifuge training that simulates the g-forces of launch and landing, participated in zero-gravity practice flights, flew in fighter jets, and hiked to a high camp on Mt. Rainier.

Although spaceflight is often depicted as glamorous — and the images of the Inspiration4 crew are no exception—the experience is anything but glitzy, even if it costs millions of dollars. Traveling to space is really about suffering and sacrifice and survival, Shindell says—and he's curious how the crew will respond to the reality of rocketing into orbit and sharing extremely close quarters for three days.

"Once you get into that capsule and commit to the mission, you're going to experience all the g-forces, all of that isolation, the intimacy with the rest of your crewmates, and the terror of coming back through the atmosphere and crossing your fingers the whole way," Shindell says.

Given the expansion of commercial flights, it's easy to see why some in the space industry are talking about the opening of a new era. But others caution that it would be a mistake to say these crews are "ordinary" or representative of humanity at large. Isaacman is one of only 2,755 billionaires on Earth — a minuscule percentage of the population who can afford to charter a spacecraft.

Even the selection process for the other crew members was based on stringent criteria, or just plain luck. Sembroski was one of 72,000 people to enter the raffle — the odds of making it through NASA astronaut selection are better. And although Inspiration4's crew is more diverse than many others, the next couple of private missions heading into orbit are populated predominantly by men, continuing a pattern that has resulted in women comprising roughly 11 percent of total astronauts. People of color account for even fewer spacefarers. (Proctor is only the fourth Black American woman to fly to orbit.)

Spaceflight is a rarified experience, Bimm says, and very much in the hands of the privileged. Whether these flights are truly heralding a new chapter in off-world exploration will become evident soon enough.

"The proof is going to be in the pattern," Bimm says. "What I would say to everyone who's watching with an interest in space is: Don't get too focused on this mission. Watch the next one, and the one after, and the one after." ●

Edited for space

RANDOM-NEST

Flight Axes

AVIATIONFILE.COM | November 9, 2020

The concept of Roll-Pitch-Yaw specifically refers to the movement of aircraft among its axes. In addition these concepts are terms used in the field of Robot Mechanics / Kinematics. Let's define these terms in aviation.

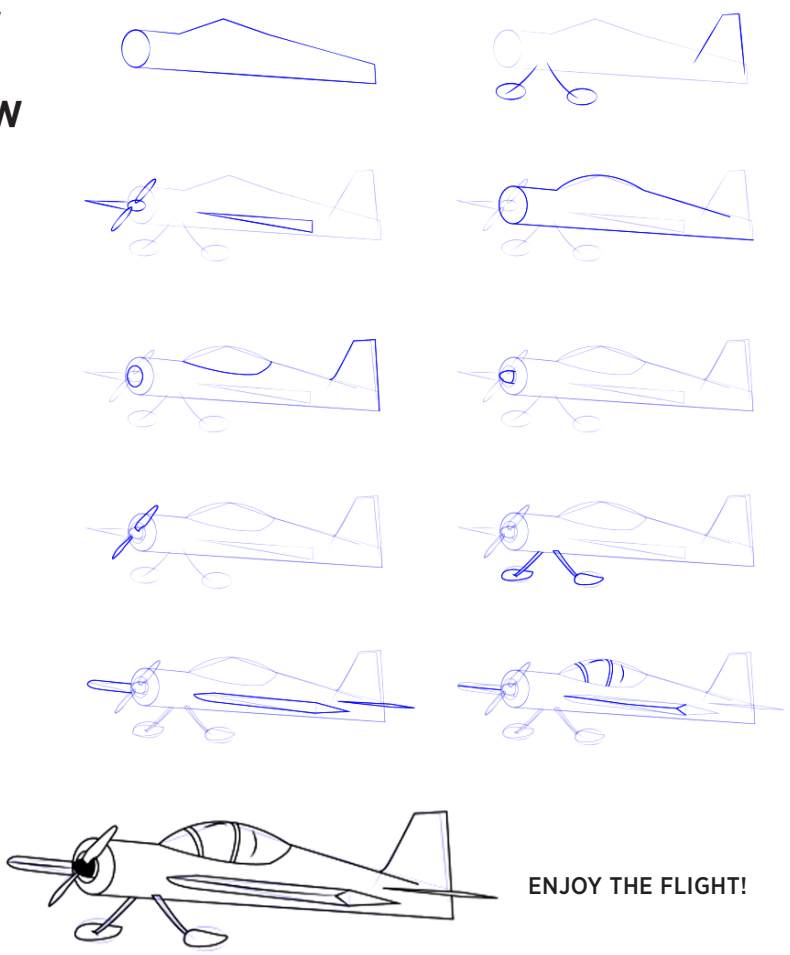
Roll axis | First, let's explain the Roll term. Roll literally means rolling, lying down. The term of roll refers to the movement among Longitudinal Axis. If we draw a straight line from the nose to the tail of the aircraft, we can call it the Z axis. The plane rotates around this line, that is, the wings move up and down. The movements of the aircraft around the roll axis are controlled by the parts like Aileron and Spoiler.

Pitch axis | Second, let's explain the concept of Pitch. Pitch literally means pitching motion. Pitch concept refers to movement among Lateral Axis (Horizontal Axis). To understand this concept more clearly, let's assume that we draw a straight line from tip of one wing of the plane to the tip of another wing. This line becomes our X axis. The rotation of the plane around this line is also called the pitching motion. This corresponds to the Pitch concept. In other words, it is the up and down movement of the nose and tail of the aircraft. The movements of the aircraft around the Pitch axis are controlled by the Elevator.

Yaw axis | Finally, let's explain the concept of Yaw. Yaw literally means going off course, turning to the right and left. Yaw concept refers to Vertical Axis. To understand this concept more clearly, let's assume that we draw a line extending from the upper part of the body to the lower part of the plane passing through the center of gravity. This line becomes our Y axis. The rotation of the plane around this line is also called Yaw (Rotation) motion. In other words, we can say that the nose and wing of the plane move left and right. The movements of the aircraft around the Yaw axis are provided by the Rudder (Direction Steering).

Edited for space and clarity

HOW TO DRAW ...



ENJOY THE FLIGHT!

Words of Encouragement

Flight has been one of mankind's dreams since the beginning of time. Obviously, we have been able to achieve it through a host of inventions, but nonetheless, we continue to make progress. I want to offer two thoughts for you this week pertaining to this. First, it has taken humanity thousands of years to achieve this, with everyone taking part in producing a product better than the last. I say this because although some people didn't actually achieve this goal, they still contributed to the pool of knowledge leading up to it. People who dream a little are the ones who drive progress, and even summoning the thought of a lofty goal can lead to something huge. Ideas are just as valuable as the products of them, so your thoughts are worth expressing and will be cherished by people such as us, who care about you. Second, that dream tells us something about the human experience. We all have similar desires, needs, and goals, even if it does not seem that way. We have more in common with our neighbors than we think, and remembering that can give us a greater understanding of each other. I hope you enjoyed this week's edition of *The Warbler,* and as always, I wish you the best and hope you have a wonderful week.

Taylor

1061 Beard-Eaves Memorial Coliseum // Auburn University, AL 36849

"Man must rise above the Earth — to the top of the atmosphere and beyond — for only thus will he fully understand the world in which he lives."

SOCRATES // Greek philosopher

Answers

SUDOKU #185

3	9	4	8	5	1	7	6	2
2	8	5	4	6	7	9	3	1
7	6	1	3	2	9	4	5	8
9	3	6	5	1	8	2	4	7
4	7	2	9	3	6	8	1	5
1	5	8	2	7	4	3	9	6
8	2	9	6	4	5	1	7	3
6	4	7	1	8	3	5	2	9
5	1	3	7	9	2	6	8	4

SUDOKU #186

8	7	4	2	1	9	5	3	6
1	5	3	6	8	7	2	9	4
9	2	6	4	3	5	1	8	7
3	4	5	8	7	1	6	2	9
6	9	8	5	2	4	3	7	1
2	1	7	9	6	3	8	4	5
5	8	2	7	9	6	4	1	3
4	3	9	1	5	2	7	6	8
7	6	1	3	4	8	9	5	2

Rebus Puzzle
Page 7

1. Double agent
2. Make a monkey out of him
3. Always on the go

Send ideas and comments to:

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UNTIL NEXT TIME !